FEDERATED MALAY STATES.

ANNUAL REPORT

ON THE

DEPARTMENT OF AGRICULTURE,

S.S. AND F.M.S.,

FOR THE YEAR

1926

BY

A. S. HAYNES,

Secretary for Agriculture, S.S. and F.M.S.

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FEDERATED MALAY STATES.

ANNUAL REPORT OF THE SECRETARY FOR AGRICULTURE, STRAITS SETTLEMENTS AND FEDERATED MALAY STATES, FOR THE YEAR 1926.

STAFF.

The establishment of the Department of Agriculture, excluding the Secretary for Agriculture, comprised 38 European officers, 26 on the Research Staff and 12 on the Field Staff, the latter including three in the Colony and one in Johore. Four of these substantive appointments were not filled during the year. Details are given in Appendix A of this report.

ADVISORY COMMITTEE.

2. The Advisory Committee was composed of the following members:

The Secretary for Agriculture (*Chairman*);
The Hon'ble Mr. J. W. Campbell, M.L.C.;
The Orang Kaya-Kaya Penglima Kinta Che Wan;
Mr. D. S. Gardner;
Mr. G. E. Henning;
Mr. L. P. Jorgensen;
Mr. W. A. Stanton;
Mr. D. H. Grist was Secretary to the Committee.

ADVISORY COMMITTEE (CHINESE AGRICULTURE).

3. The Advisory Committee (Chinese Agriculture) was composed of the following members:

The Secretary for Agriculture (*Chairman*);
The Chief Agricultural Field Officer;
Mr. Khoo Keng Hooi, J.P.;
Mr. Yap Tai Chi, J.P.;
Mr. Yap Tai Seng.

The Chief Agricultural Field Officer was also Secretary to the Committee.

RUBBER.

4. MARKETS.—The price of rubber in Singapore opened at $1.54 per lb., but declined steadily during the first two months and had fallen to 85 cents per lb. at the end of February. During March it rose temporarily to $1.08 per lb., but subsequently declined till it reached 65 cents per lb. at the beginning of May. Thereafter it remained steady between 65 and 75 cents per lb. till November when it fell to 60 cents per lb. At the close of the year it stood at 65 cents per lb.

5. EXPORTS.—The rubber exported from the Federated Malay States during 1926 was 164,406 tons including 2,056,377 gallons (3,218 tons) of latex as compared with 118,590 tons including 2,292,282 gallons (4,180 tons) of latex in 1925.

The net of exports of rubber from the whole of Malaya in 1926 were 240,090 tons of rubber and 2,078,701 gallons of latex as compared with 158,803 tons of rubber and 2,315,439 gallons of latex in 1925.

6. STANDARD PRODUCTION AND RESTRICTION.—The "Standard Production" for the fourth Restriction Year (November 1st, 1925, to October 31st, 1926), for the Federated Malay States was estimated to be 162,208 tons compared with 159,874 tons in the previous year.

The Exportable Allowance was as follows:

January	85 per cent.
February to October	100 ,,
November and December	80 ,,

7. STOCKS.—Rubber stocks in the United Kingdom were stated to be 6,250 tons on the 1st January, 1926, but they increased steadily during the year to 51,243 tons on the 31st December. The world's visible stocks at the end of the year were said to be about 65,000 tons higher than at the end of 1925.

An important factor partly responsible for the increase of stocks and the attendant fall in the market price was undoubtedly the high percentage of standard production released for export from the restricting countries. Another important factor would appear to be the reported large increase in the consumption of reclaimed rubber in America, which is stated to have risen from 137,000 tons in 1925 to between 165,000 and 185,000 tons in 1926; the corresponding ratios to crude rubber were 35 per cent. in 1925 and 47 per cent. in 1926. The increased supplies from native holdings in the Netherlands East Indies, the effect of which was feared in some quarters, did not materialise, the production from this source remaining unchanged, but the production from estates in the same countries increased by 17,000 tons.

8. General.—The average price realised during the year was sufficient to maintain all properties in good order and yield a fair profit to owners or shareholders. Many of the smaller holdings have improved in condition.

The renewed confidence of the investing public in the future of the industry, consequent on the recovery in price during 1925, is indicated by the fact that, whereas in 1925 the newly planted area is estimated at about 20,000 acres in the Federated Malay States, Johore and Kedah, the area planted in these States during 1926 is estimated at about 60,000 acres.

The first four months of the year were unusually hot and dry, causing an exceptionally thorough and simultaneous "wintering" (annual leaf-fall) of rubber throughout the country.

9. Tapping.—Sound and conservative systems of tapping are now the rule on practically all estates. The Agriculturist (Rubber) visited a large number of small holdings in order to ascertain if the high price of rubber in the latter part of the year 1925 and the early part of 1926 had affected the quality and severity of tapping on small holdings. He found little evidence that the higher price had had an adverse affect, the systems on the average being more conservative and the quality of the work of a higher standard than in former years. In some instances, however, a more severe system was adopted and more bark was removed during the period of high prices. These instances may have been due to the unsatisfactory practice of farming out rubber holdings on the profit sharing basis, a practice which is still too prevalent among Malays and naturally leads not only to extravagant systems of tapping, but also to general neglect of upkeep and disease control.

10. Cultivation.—Interest in the problem of manuring rubber trees, stimulated by the successful results obtained by a large company in Sumatra, has been maintained.

Little information, relating to Malaya, is yet available to show what results may be expected from the application of artificial manures to rubber trees. For the purpose of obtaining such information test plots, planned by officers of this department, have been established on certain estates.

The Agriculturist (Rubber) further investigated the effect of permitting the growth of ferns as a soil cover on the health and growth of rubber trees. The results were published in the *Malayan Agricultural Journal*, Vol. XIV, page 119. No indications of harm caused by the fern growth were observed, provided that the cover was kept free from lalang and was cut occasionally. In order, however, to obtain reliable data, experiments have been laid down on certain estates to test the value of ferns as a cover crop and to throw further light on this subject generally.

Silt pitting and the growth of cover crops to prevent soil erosion are now beginning to form part of the ordinary upkeep of the large estates owned by Asiatics, as they already do on European properties. For young areas *Calopogonium mucunoides* has been found to be a very suitable cover crop, while on older areas, provided that the soil is not impoverished, the Sarawak Bean (*Dolichos Hosei*) does well. *Mikania Scandens*, a non-leguminous plant common in this country, shows promise as a soil cover, since it grows rapidly and thrives under shade.

11. Bud-Grafting.—Certain estates in Kedah, Selangor and Johore have imported large quantities of bud-wood from selected trees in Sumatra and have used it to establish young clearings with budded trees. In a few instances selected seed from Java or Sumatra has also been imported for this purpose. The yields of clones of budded trees, taken from local mother trees, on an estate in Selangor have been recorded by the Agriculturist (Rubber) and published in the *Malayan Agricultural Journal*, Vol. XIV, pages 25 and 351. The results shown are satisfactory. Observations made by the same officer on the union of the stock and the scion show that the age of the stock has a considerable influence on the future growth of the tree, though other factors, such as the age of the bud-wood, probably also contribute. Seedlings between 6 and 12 months old are recommended as the most suitable stock for budding. Investigations on the suitability of different kinds of bud-wood are in progress.

12. Replanting.—Some estates possess areas of old rubber trees originally planted on land impoverished by former crops, such as coffee or tapioca, and subsequently subject to continuous erosion for many years. The trees in such fields in time become starved and unable to yield any paying crop, while eventually even the hardiest weeds can bearly exist. Interesting experiments on reconditioning and replanting such land have been conducted on some estates and this problem has received attention from the Agriculturist (Rubber) and the Agricultural Chemist. After the old trees have been removed, thorough tillage is essential and this is often accompanied by liming. Bunding to prevent soil erosion is necessary on undulating or hilly land. Light growths of weeds and green manures, such as *Tephrosia candida*, are rendered possible by the tillage and these are dug in periodically to supply humus. The successive growths increase in quantity as the soil improves. Artificial manures can also be used. Eventually cover crops can be established; *Calopogonium mucunoides* being useful for this purpose, or a mixed growth of *Calopogonium* and Sarawak Bean, or other covers. When the soil will support a good growth of weeds the area can be replanted with rubber. One or two experiments on these lines have given promising results.

13. Diseases and Pests.—Pink Disease (*Corticium salmonicolor*) was comparatively quiescent during the dry first half of the year, though numerous old cases were found in small holdings along the Pahang River in Kuala Lipis district, requiring careful attention to ensure adequate treatment. Wetter weather later in the year caused recrudescences of the disease in various localities, in all of which the Inspecting Officers enforced adequate treatment. On the whole the disease does considerably less damage to rubber than it did some few years ago, partly because there are fewer young trees of a very susceptible age, and partly owing to the improved knowledge of the disease and its treatment imparted to rubber planters by the Field Officers.

Mouldy Rot (*Sphæronema fimbriatum*).—In most infected localities this disease was not much in evidence during the dry weather, but with the advent of showers later it reappeared in all of them and spread to several new centres in Perak, Selangor, Pahang and Singapore Island. One attack worthy of mention occurred near Sungkai in June. The disease had not previously appeared in the South of Perak. Trees on seven small holdings were attacked. The control measures promptly carried out were quite effective, so that there was no subsequent reappearance of the disease up to the end of the year. In Singapore Island there was a new outbreak in August. The disease spread rapidly during the wet weather at the end of the year and by December properties in the centre and east of the Island had recently become infected. In October the Chief Field Officer, at the request of the Kedah Government, made a report on the control of this disease in South Kedah where there had been a considerable extension of the area first found to be infected at the end of 1925.

Black Stripe (*Phytophthora sp.*).—Cases were found in most States, but the disease has on the whole been of little importance. One outbreak on an estate in Malacca did some damage before it was controlled.

Collar Patch Canker.—A type of patch canker in Malaya has been shown to be caused by a fungus different from *Phytophthora faberi* which causes this disease in other countries. The form of this disease which affects the collar is considered to be by far the most serious. Scrapping away the diseased tissues in ordinary cases of Patch Canker on the stem is considered dangerous, and it is recommended that the attacked cortex should be cut out in large pieces, so that there may be no danger of any small portions of diseased tissue falling on the exposed lateral roots and there starting new infections which may rapidly spread to the collar.

Brown Bast.—This calls for little comment. Estates tapping on alternate days are seldom troubled with this disease. Restriction of output has tended to decrease the number of cases.

Wet Rot (*Fomes pseudo-ferreus*).—Control work on this root disease begun in 1925 was carried on intermittently during the year. Over the period, comprising ten months, it was found that approximately 30 per cent. of the total number of trees opened up could be successfully treated by the excision of slightly infected lateral roots. The costs of the work, which had at first been $3 a tree with Chinese labour, were reduced to 65 cents a tree with Tamil labour during the last month. It must be emphasised that this method of treatment is only likely to be economically sound if the disease is tackled when it first appears—that is on trees about 12 years of age. In cases where the trees are old, i.e., about 20 years of age and the percentage of them badly infected is in consequence high, it would appear a sound policy to allow the disease to take its course, getting all the rubber possible from the trees in the mean time; to remove carefully and burn the trees as they die; and eventually to replant the field.

Fomes Lignosus.—An interesting case of a bad attack of this fungus on young rubber was noted, in which the old stumps of Kempas (*Koompassia malaccensis*) were the main sources from which the original attack commenced. Special treatment was recommended, but the results are not yet available.

Sun Scorch.—The "wintering" period, 1926, was abnormal with an unusually prolonged dry period and scorching sun. Trees were leafless for longer than is usual. On several estates symptoms of disease appeared on exposed lateral roots; the wood beneath the dead bark showed "Diplodia" discolouration and this fungus was isolated from the diseased tissue. It has been clearly established that the damage was originally due to sun scorch and a successful course of treatment was prescribed. The results recorded were published in the *Malayan Agricultural Journal*, Vol. XIV., page 116.

Diplodia and Dieback.—The work on sun scorch led to inoculations being carried out with the *Diplodia* sp. isolated from the roots. The interesting conclusion was reached that the *Diplodia* sp. associated with rubber tree affections, such as "Dieback", "Lightning Strike" and "Sun Scorch of Lateral Roots" is not an ordinary wound parasite, as hitherto commonly believed, but is a specialised form of wound parasite which, under certain conditions allowing for sufficient heating of localised areas of cortical tissue, can produce a strong infection enabling the fungus to make rapid headway in the woody tissues of *Hevea Brasiliensis*. From further enquiries as to the fungi responsible for bad attacks of dieback found on impoverished soils, it appears that fungi other than *Diplodia* sp. commonly assumed to be mainly responsible for dieback of rubber branches, must be considered of major importance in connection with this problem. (*Malayan Agricultural Journal*, Vol. XIV, page 287.)

Branch Ustulina (*Ustulina maxima = U. zonata*).—On many coast estates this fungus has been responsible for heavy losses, as it finds easy access through broken branches and grows into the stem of the tree. Owing to pressure of other work no time could be given to this.

Helminthosporium Hevea.—Was noted during the year in an interesting attack on seedling leaves.

Insects damaging Renewing Bark.—Several reports of damage to the tapping surface of rubber trees by insects have been received during the year. Possibly the insect most frequently reported as causing damage is the "case worm" *Acanthopsyche snelleni*, but crickets and *Homodes brachteigutta* have also been found responsible. Caterpillars of *Palara uniplexta* were alleged to have injured the tapping cuts on trees throughout a fairly large area of an estate in Negri Sembilan.

Insects attacking Cover Crops and Young Rubber.—The Entomologist on one occasion found that the caterpillars of a lymantrüd moth, *Orgyia turbata*, had not only seriously damaged a cover crop of centrosema on an estate, but had also migrated thence to young rubber trees and had fed on their leaves. The possibility of damage to rubber through pests on cover crops is easily exaggerated, but should always be remembered and guarded against.

14. Physiological Investigations.—These continued and extended previous lines of work connected with coagulation and with the proteins and other non-caoutchouc constituents of latex. Four hitherto unrecorded bodies were isolated, three of which were proteins differing in coagulation properties, while the fourth was a waxy phospho-compound. A number of methods of preparing this fourth body were investigated. These results were published in the *Malayan Agricultural Journal*, Vol. XV, page 27. In addition to this two further articles summarising the conclusion of this work are in course of preparation. Observations on experiments on early and drastic thinning out of rubber were continued.

15. Chemical Investigations.—For the purpose of commercial dealings in preserved (ammoniated) latex it is important to be able to determine exactly the dry rubber content by a rapid and accurate method. Work has been done to investigate the causes of variations in dry rubber content which have been found to occur when different methods are applied to samples of latex and, in an article published in the *Malayan Agricultural Journal*, Vol. XIV, page 1, an attempt has been made to explain how these variations can be allowed for and more exact and uniform results be obtained in commercial practice.

Work was undertaken to determine if added impurities would account for accidental abnormalities in tensile strength, which have been found to occur unexpectedly, at times, in samples of vulcanised rubber. The results were published in the *Malayan Agricultural Journal*, Vol. XIV, page 53. They indicated that adventitious impurities, added to the latex after leaving the tree, do not account in full for such abnormalities, and that a more complete explanation must be sought in the inherent characteristics of the latex issuing from the tree.

Investigations on the accelerating properties of some alkaloids during hot vulcanisation showed that certain bye-products, left after the separation of emetin from ipecacuanha, are effective in accelerating vulcanisation. These results may lead to a valuable use for these bye-products.

The relative merits and demerits of alum as a coagulant have been made the subject of a special enquiry with the result that the action of the Department of Agriculture in condemning the use of alum has received the support of the large consumers in Europe and America.

It appears from correspondence with these consumers that plantation rubber is still rather lacking in uniformity. In this connection interest is attached to the results obtained from the examination of a series of samples which were collected from rubber exhibits shown at various Agricultural Shows in different parts of the country. These samples supported the contention that first class sheet and crepe show more variation in vulcanising properties than is generally credited. These results will be published shortly.

A concentrated form of latex known as Revertex, is being prepared on an estate in Malacca as a result of investigations by Dr. Hauser. This has been exported since the early part of the year in commercial quantities and may lead to new industrial applications for latex.

The erection of the necessary plant for the preparation of sprayed rubber was in progress in Singapore during the year. When it is completed several of the larger estates in Johore will send their latex to this factory.

16. Rubber Research Institute.—The Director (Dr. G. Bryce) was appointed and assumed duty on the 26th September, 1926.

The Institute was officially opened on the 1st November, 1926, although the laboratories are not yet properly equipped and only a few members of the staff were appointed before the end of the year.

The Rubber Research Institute should serve the needs of all classes of rubber growers in Malaya. It will relieve the Department of Agriculture of most of the work connected with rubber, except the work of control of diseases, and enable the department to devote more time and attention to investigations on the other major crops, rice, coconuts and oil palm; to the improvement of minor crops, vegetables, fruit trees and stock; and to experiments with plants likely to provide suitable new crops for Malaya.

COCONUTS.

17. Markets.—At the beginning of January the Singapore price of copra was $12 per pikul. During the year it varied between $12.30 and $10.10 to which price it had declined at the end of December. The average price was about $11.80 as compared with $12.15 in 1925.

18. Exports.—The exports of copra from the Federated Malay States for 1924 to 1926 are shown in the following table:

State.	Quantity in tons.			Value in dollars.		
	1924.	1925.	1926.	1924.	1925.	1926.
Perak	38,545	40,007	44,542	6,914,055	7,830,274	8,905,033
Selangor	12,900	15,426	16,963	2,427,188	2,909,119	3,212,553
Negri Sembilan ...	1,179	2,236	3,417	203,930	463,494	575,451
Pahang	560	315	907	95,839	57,412	158,733
Total F.M.S. ...	53,184	57,984	65,829	9,641,012	11,260,299	12,851,770

The net exports of copra from British Malaya during the last two years were:

	Quantity in tons.	Value in dollars.
1925	96,554 ...	19,093,938
1926	104,653 ...	21,852,330

19. General.—The industry has continued in the same satisfactory condition as in the last four years. Its slow but steady extension is a satisfactory feature of agriculture in Malaya during the last decade. Unfortunately the lack of suitable land must before long put an end to expansion of the area under this crop in Perak, Selangor and Negri Sembilan.

20. Experimental Investigations.—Records of yields from 530 individual palms on two estates, which have been maintained for six years, show the value of selection work on this crop. Palms selected as high yielders continue to demonstrate this character convincingly, while the poor yielders have consistently given few nuts.

Good progress is being made at the Coconut Selection Experiment Station near Klang. Plantings are now almost completed and growth is satisfactory. The plantings include 85 lots of 25 palms each, selected as heavy copra producers, and 35 lots representing different types in Malaya.

The Chemical Division is investigating the variation in oil content of the copra derived from the nuts of the palms selected for heavy copra production.

21. Diseases and Pests.—Bud-rot—One of the classical epidemic diseases is that known as "Bud-rot" of coconut palms, which in the case of true "Bud-rot" is caused both in the Western and Eastern Hemispheres by *Phytophthora palmivora*. Rotting of the bud is, however, no proof that *P. palmivora* is present, since it may be the culminating point of any affection which leads to a gradual lowering of disease resistence in various kinds of palms. In Malayan coconut plantations bud-rot has been found as the last stage in several different affections, but careful work has substantiated the view that these cases can always be placed in a different category from the true "Bud-rot" caused by *P. palmivora*. "Lightning Strike" has been found to be the cause of one form of bud-rot, while decomposition of the bud is the final stage of the two diseases, Lignification of the Stem and Soft Salmon-Pink Disease, referred to below.

Lignification of the Stem.—This disease is typically characterised by a hard lignification of all tissues of the stem with the vascular bundles showing up prominently owing to a marked brownish red discolouration. Recent investigations strongly indicate that this is in reality a slow root disease caused by a fungus which, after entering the wood of the roots, progressively attacks the water-carrying vessels in the stem. As the water supply is reduced the leaves become smaller and smaller and finally the trees die. Further work to isolate the fungus and reproduce the disease by inoculation is necessary to establish beyond question the cause of these symptoms.

Soft Salmon-pink Disease.—The typical symptom of this disease is the soft salmon-pink discolouration of the internal tissues of the stem from which it has been named.

Polyporus ostreiformis was isolated from such diseased tissues. Artificial pure cultures of this fungus were established from which inoculation are now in progress.

A number of cases of the two diseases described above have been reported in the last few years from various parts of the country, so that they were becoming of considerable importance. Their elucidation has proved a matter of difficulty, complicated by the fact that both may be found in the same palm and that a rotting of the bud occurs in their final stages. Recent work, however, appears to justify their separation and has provided clues which it is expected will lead to a full understanding of their cause, origin and progress.

Marasmius sp.—This fungus which was previously reported as causing a disease of fruit bunches of oil palms has recently been found damaging two-year-old coconut palms. The bases of the affected palms were rotted away to a black fibrous mass and the death of the palms resulted. The identification of this fungus has not yet been received.

Artona catoxantha.—Three papers dealing with this moth and its parasites, embodying the results of recent observations, were published in the *Malayan Agricultural Journal*, Vol. XIV, No. 10. These investigations had to be discontinued as there was no outbreak of this pest during the year.

The Greater Spike Moth (*Tirathaba sp. nr. trichogramma*).—Investigations on the control of this insect show that if the sheath is entirely removed, the damage caused to both male and female flowers is insignificant. This measure is so entirely successful that further experiments for the control of this moth are not considered necessary. Preliminary figures obtained on an experimental area indicate that when the spikes are allowed to open naturally about 30 per cent. of the original female flowers remain on the spikes to become nuts, about 10 per cent. are damaged by the caterpillars of this insect and about 60 per cent. fall from other causes.

Black beetles (*Oryctes rhinoceros*) have been kept well under control in Negri Sembilan and Malacca. There has been a reduction in the number of breeding grounds suitable to them in Penang and Province Wellesley and in the districts of Kinta, Kuala Selangor and Klang where they are usually somewhat in evidence. In Singapore Island the spread of the town into the rural area has necessitated the felling of a number of coconut palms, the disposal of which has required attention.

Miscellaneous Insects.—A large grasshopper (*Valanga nigricornis*) has occasioned some damage to coconuts, oil palms and areca palms where giant mimosa has been grown as a cover crop. The insects appear to be attracted first to the cover plant and then proceed to injure the palms. Caterpillars of the psychid moth *Mahasena* sp. give rise to most enquiries relating to insects on coconuts during the year. Caterpillars of *Setora nitens* injured young coconuts, the damage being confined to palms under five years old. The Skipper, *Hidari thrax*, was responsible for localised damage. The two coloured hispid beetle, *Plesispa reichii*, was more in evidence in some parts of Malaya on young palms and it is recommended that seedlings should be immersed in lead arsenate before being transplanted in the field. A bug *Oliarius* sp. was found on young palms in Klang district where its appearance constituted the first record of injury to coconuts in Malaya by this insect.

22. Dwarf Coconuts.—Records of the flowering and fruiting characters of races of dwarf palms growing in the compound of the Departmental Office at Parit Buntar, inaugurated in 1925, were maintained and over 300 seednuts were despatched to Klang, Taiping and Malacca from these palms which are now bearing very freely. There is a big demand for seednuts from these palms locally, though they are in no way to be considered as selected except as useful types. Seednuts of dwarf palms have been despatched to Trinidad and the West Coast of Africa for experimental cultivation.

OIL PALMS.

23. Areas Cultivated.—Interest is still maintained in the cultivation of oil palm which shows promise of becoming an important major crop especially in view of recent improvements in machinery for extracting the oil and for cracking the kernels. There are now nineteen oil palm estates in Malaya, excluding small experimental areas. Of these, one has over 2,000 acres planted, three have between 1,000 and 2,000 acres and five have between 400 and 800 acres planted. Three have reached the bearing stage. The total area alienated for this crop in Malaya is 45,322 acres of which 12,548 acres are planted. The Government of the Federated Malay States has provisionally reserved for this cultivation additional areas amounting to 118,560 acres mostly in Pahang. It is not yet proved, however, that all these areas are suitable for oil palm. The principal planted areas are distributed as follows:

Perak.	Selangor.	Johore.	N. Sembilan.	Kelantan.
842 acres ...	9,357 acres ...	1,992 acres ...	100 acres ...	200 acres

24. Production.—The yields in tons of palm oil and of kernels in Malaya during the last four years have been:

	1923.	1924.	1925.	1926.
Palm oil	195 ...	286 ...	536 ...	751
Kernel	50 ...	81 ...	110 ...	168

There are now two up-to-date extraction and nut-cracking plants and another is to be erected in 1927.

25. Cultivation.—The department is experimenting at Serdang with new varieties of oil palm from West Africa with a view to selecting improved strains of seed for distribution to planters in this country.

Experiments recently carried out at Serdang have shown that the germination of oil palm seeds can be considerably accelerated by placing the seeds in pure sand beds covered with glass frames, to increase the temperature of the germination beds. These experiments will shortly be published in the *Malayan Agricultural Journal* and should prove of practical value.

Other investigations in progress at Serdang refer to: crop records; artificial pollination; effect of light and heavy pruning; growth records; and the effect of intercrops, catchcrops, cover crops and green manures.

It is of interest to note that during the year the Governments of the Gold Coast and Nigeria each sent an expert to study the plantation industry here and in the Netherlands East Indies.

26. Chemical Investigations.—The process of oil extraction on four estates has been tested with a view to comparing the efficiencies of the types of factory plant in use. The data collected will be incorporated in a special publication on oil palm now in preparation.

27. Diseases and Pests.—Two interesting cases of diseased fruit bunches have been recorded for future investigation. One appeared on bunches of fruit produced by palms that had been artificially pollinated. The pericarp of the individual fruits became very soft and slimy. This disease has not up to the present been found on

naturally pollinated palms. The other affection is a hardening of individual fruits which renders it difficult to detach them from the bunches. It appears to be a form of premature ripening. Such fruits are said to be useless for oil production. A number of insects have been observed to feed on the leaves of oil palms, but up to the present none have proved of major importance.

PADI (Rice).

28. Area and Crops.—The area planted with wet padi for the 1926 harvest was stated to be 163,120 acres in the Federated Malay States and 583,715 acres in the whole of Malaya. The corresponding crops reaped are given as 31,368,362 gantangs and 113,438,589 gantangs, respectively. The Peninsula also produced 10,055,482 gantangs of dry padi from 82,182 acres of which over 60,000 acres were in Kelantan.

Satisfactory crops were obtained in Pahang and Malacca and also in Upper Perak and Kuala Kangsar districts of Perak. Elsewhere the harvest was on the whole well below the average. Floods ruined the crop along the Perak River in South Selangor. In the north, drought in the planting season was followed by heavy rains and floods in December, and the damage done by deep water was accentuated by the attacks of the delphacid bug, *Sogata pallescens*, which appeared in enormous numbers at the end of December, 1925, and disappeared again within a few weeks. In Krian selected strains of padi proved more resistant to the attacks of this insect than did unselected local strains, so that the extensive use of the selected strains, aided by dry weather at harvest, did much to counterbalance the harmful effects of deep water and insect attack and a nearly average crop of 14,000,000 gantangs was obtained from this important padi district. On account, however, of the poor average crops generally, and especially in Kedah, the prices realised were high, ranging from 16 to 18 cents per gantang. Statistics of the padi crops are given in Appendix B.

The crop for the forthcoming season will be only about 70 per cent. of the normal owing to adverse weather conditions. Drought rendered planting late and irregular in many places. In the north it was so prolonged as to threaten entire failure of the crop, which was saved in part by steady rain for some days after Christmas. In spite of this the Krian crop is expected to be only about 13,000,000 gantangs which is 1,000,000 gantangs below the average. Elsewhere the rain caused disastrous floods which destroyed the crop along the Perak and Pahang Rivers and in Kelantan. Only in Malacca was the water supply normal and the crop promising.

29. Selection Work.—Pure line selection work was continued at the Titi Serong Rice Experiment Station with 28 strains; similar work commenced at the Pulau Gadong Station with the varieties Nachin Puteh and Padi Siam, popular in Malacca, gave promising results, in spite of an adverse season and the attacks of pests. Twenty-six selected pure-line strains subjected to yield tests both in Krian and other districts have maintained their high yielding qualities demonstrated during five years' testing at Titi Serong. Seven strains in particular are now popular among growers, so that large areas are planted with them annually in Krian and other parts of the Peninsula. New Test Stations were opened at Bota in Perak and near Kajang in Selangor during the year, but the results of the first season's work were rendered useless by the floods, which also destroyed the entire crop at Talang Test Station near Kuala Kangsar and most of that at the Dong Station in Pahang.

The popularity of the selected strains and the loss due to floods caused an increased demand for seed padi. The distribution amounted to 15,371 gantangs of selected seed of which 5,165 gantangs were distributed to growers in Krian and 10,206 gantangs were sent to other parts of Malaya. Of this supply, 10,021 gantangs were grown at Experiment or Test Stations and 5,350 gantangs were purchased from growers in Krian. The results obtained with selected strains in Perak North were summarised by the Agricultural Field Officer Mr. F. Birkinshaw in a paper published in the *Malayan Agricultural Journal*, Vol. XIV, page 272.

30. Cultivation and Manuring.—Manurial and cultivation experiments were continued. No conclusions can safely be drawn from the three seasons' results at Titi Serong, but it was noticeable that better growth and increased yields were obtained from plots which were given simple cultivation or received an application of a phosphatic manure, whilst the plots from which straw, grass and weeds were removed, or burnt, showed decreased yields of grain. Similar work was conducted at the Pulau Gadong Experiment Station in Malacca and the Pekan Darat Test Station in Province Wellesley, but the results for the season were adversely affected by weather conditions. In a few years, however, the work in progress at these stations should yield valuable information.

31. Rice Storage.—A plan of an experimental rice store was drawn up, and a scheme of rice storage experiments will be undertaken as soon as the store is completed.

32. New Areas.—The survey of the large area between the Perak River and Sitiawan was continued and soil samples were collected by the department for examination. Final conclusions regarding this area have not yet been reached. In Pahang there is no large population to settle on new areas for padi cultivation, but in some districts there is a gradual extension of relatively new areas. It appears likely that an area of what is believed to be very suitable land at Bebar on the coast of the Pekan district may attract settlers as progress is made with the construction of the Pekan-Bebar path.

33. Pests and Diseases.—Investigations on the economic importance and control of the various species of Padi Fly (*Leptocorisa spp.*) were in progress throughout the year, but have not yet been concluded. The species found to cause 90 per cent. of the damage to padi is *L.acuta* though swarms found after the padi season is over nearly always consist of *L.varicornis.* Control measures successfully prevented serious damage in Kuala Pilah district in the 1926 season.

The leaf-hopper *Nephotettix bipunctatus* caused some damage to padi in Malacca and was associated with the delphacid bug, *Sogata pallescens* on padi in Krian district early in 1926. Caterpillars of *Nymphula depunctalis* damaged the nurseries at the Pulau Gadong Station and elsewhere in Malacca; *Scotinophora coarctata* was the most important padi pest in Eastern Pahang: mole crickets, *Curtilla africana* did some damage to padi on the banks of the river in Lower Perak district. Various stem borers were troublesome in most localities; they were fairly numerous on the 1926 crop in Province Wellesley and on the 1927 crop in parts of Selangor. Hill padi in a new clearing in Selangor was severely damaged by the caterpillars of a noctuid moth, *Agrotis sp.*, but control measures were unnecessary as a high percentage of the caterpillars found to be parasitised.

34. Rat Campaign.—The special rat campaign was continued in Krian throughout 1926, as a result of which over 673,000 rats were accounted for against 652,000 in the previous year. While these results have greatly reduced the damage caused by these pests, there seems no hope of exterminating them, and it will be necessary, therefore, to continue the work, so long as the cost seems justified by the damage prevented.

35. Resliming Experiments.—The plots at Kamunting for testing the effect of green manures in restoring the fertility of reslimed mining land were maintained and extended. The best cover plants have proved to be *Tephrosia candida* and *Mimosa invisa. Crotalaria anagyroides* has also done fairly well, but *Crotalaria usaramoensis* succumbed to root disease and appeared to require better drainage than is practicable or desirable in these experiments. The extended area has been divided into plots containing different green manure plants. After two or three more seasons under these plants the plots will be planted with padi to test their relative effect in improving the soil.

MINOR CROPS.

36. Statistics.—The cultivated areas under minor crops in the Federated Malay States are approximately as shown in the following table:

Crop.	Perak.	Selangor.	Negri Sembilan.	Pahang.	Total.
Pineapples ...	407	3,954	313	50	4,274
Nipah	4,225	1,643	413	800	7,081
Coffee	166	4,163	549	55	4,933
Tapioca ...	26	959	238	250	1,473
Gambier ...	—	80	1,150	5	1,235
Tuba	395	3	230	—	628
Arecanuts ...	170	106	—	700	976
Sago	106	—	—	—	106
Kapok ...	88	70	—	50	208

The nipah areas include those that either are definite plantations, or areas worked for the production of "Atap" or of cigarette wrappers. All the figures in the above table relate to definite areas, and do not include the numerous native homesteads of mixed fruit and other forms of cultivation.

37. Pineapples.—The following were the exports of canned pineapples from Malaya during the last three years:

	1924.	1925.	1926.
Weight in tons	39,204	43,207	40,634
Value in dollars	8,873,977	8,236,824	7,669,784

The decrease in exports is due to the falling off of crops, and to a reorganisation among canners. It is reported that there are several good areas coming into bearing in Johore, so that supplies should be maintained in the next few years.

The principal areas under cultivation are in Johore (15,000 acres), and in Singapore Island. There are seven factories in Southern Johore, and four or five in Singapore, the only one in the Federated Malay States being at Klang. The importance of pineapple cultivation in Malaya was emphasised in the report of the Imperial Economic Committee. This report was reviewed and abstracts were sent to all important pineapple canners and exporters in Malaya.

The Chinese producers are now making efforts to improve the grading and packing of the local produce to meet the needs of consumers. Singapore pineapples form a minor luxury which, on account of its cheapness, is much in demand in the United Kingdom. If grading and packing can be improved without causing an undue rise in the price, the export trade should be capable of considerable expansion.

The Agricultural Chemist is investigating the possibility of utilising the waste products which accumulate at the factories during the preparation of the fruit for canning.

The collection of different varieties of pineapples has been continued and several different types have now been established at Serdang. It will require time to classify them, but when this has been done it will be possible to distribute a number of improved varieties throughout the country.

38. Tapioca.—Johore (16,500 acres) and Kedah (10,500 acres) are the two States in which the largest areas of tapioca are now cultivated. Recent enquiries have enabled this department to recommend that the prohibition on this cultivation in the Federated Malay States be removed, as, under proper conditions, it may be a very useful catch crop in connection with permanent cultivation such as rubber, provided that only two crops are taken without manuring. In this connection an interesting article was published in the *Malayan Agricultural Journal*, Vol. XIV, page 361.

Experiments are being conducted to determine the actual quantities of nitrogen, phosphorus and potash removed from the soil by an average crop of tapioca. These involve analyses of samples of the crop and also comparative analyses of the soil at the beginning of the experiment and after the removal of each crop. Useful preliminary work has determined the methods of analysis to be employed.

Other experiments started at Serdang with the object of establishing a suitable rotation for this crop have been continued and the first crop was harvested during the year.

A number of new varieties of tapioca were introduced from Java and the Philippine Islands. A paper showing the comparative yields of these and of native varieties is in preparation.

Some work has been done in relation to attacks of the root fungus *Selerotium Rolfsii* on tapioca and Jerusalem artichoke.

39. Coffee.—There has been a fair demand for both Liberian and Robusta coffee and good prices have been realised for these products during the year. As a result numerous enquiries have been received regarding the planting of coffee on a small scale to meet local requirements. At the present time the planted area in the Peninsula is estimated at about 6,000 acres. To render Malaya self-supporting in this respect a further 25,000 acres in full bearing would be necessary.

40. Nipah.—The possibilities of nipah palm estates as a future source of power alcohol have recently attracted some notice.

There are two existing estates in Selangor with a total planted area of over 900 acres of palms varying in age from a year to nearly four years. The growth is reported to be excellent and the older palms are already fruiting.

The department has records of yields taken over a period of two years from some palms eight to nine years old growing in conditions less favourable than those on estates. These records show that yields of 1,000 gallons of alcohol per acre per annum are quite probable, so that in this respect the prospects appear to be bright. Ultimate success will depend on overcoming such difficulties as maintaining a large enough tapping force and finding a stable and satisfactory market.

Nipah palms in one instance suffered extensively from the attacks of nettle caterpillars, the larvae of the limacodid moth *Parasa lepida*. This is not the first record of an outbreak of this insect, so that, where nipah is grown on a commercial scale, material to combat this pest should always be in readiness.

41. Fibres.—Although at the present time practically no fibre crops are cultivated in Malaya, the department is continuing to explore the commercial possibilities of several, since among them may be found a useful alternative crop in time of need.

Sisal Hemp.—A commercial sample of about four tons of fibre was prepared at Serdang with the experimental decorticating machinery recently installed. Of this, three tons were sent to London and one bale was sent to Hongkong. The reports on both samples were favourable and showed that there would be a ready market for fibre of this quality. The price quoted in Hongkong was 10 cents (Straits currency) per lb. c.i.f., Hongkong.

It appears from local observations and from the reports received that the conditions in Malaya are quite suitable for the cultivation of sisal hemp on certain types of soil.

Pita (or Arghan) Fibre (*Bromelia Magdalene*).—There is now evidence, resulting from examination of samples from Serdang and elsewhere, to show that the leaves of the pita plant do not yield more than 2 per cent. of fibre and that the fibre does not possess exceptional qualities.

Terap Fibre (*Artocarpus Kunstleri*).—Investigations on this fibre have been continued. An offer has been received from Jute Industries Ltd., through the Cotton Fine Spinners, to spin and weave a suitable batch of this fibre. A consignment of 3 cwt. of material, prepared from trees grown in bush at Serdang, is now ready for despatch. The report on this consignment and the year's records on tree girth development will be published in due course.

42. Areca Nuts.—The results of investigations by officers of the department concerning the life history and varieties of the palm itself, the various characters of local and foreign commercial samples, the areas planted and market conditions in this and other countries were published in the *Malayan Agricultural Journal*, Vol. XIV, page 202. The investigations indicate that this is a crop which would justify expansion under plantation conditions.

A comprehensive collection of the seed of local varieties of areca palm has been made and planted in nurseries at the Coconut Selection Experiment Station, Klang. Germination has been good and before long the seventeen different varieties collected should each be represented by some 30 well-established trees. These in time will provide material for a study of the relative commercial values of the nuts obtained from each variety. Different varieties of nuts show considerable differences in the characters of importance on the market, so that the use of the right type of seed nut will considerably affect the ultimate success of a plantation.

During the year there have occurred instances of serious damage to the young unopened leaves of areca palms caused by the grubs and adults of the hispid beetle. *Wallacea palmarum*. In some cases the palms have been killed.

43. Gambier.—A study was made of the tannin content of commercial samples of gambier as compared with the ruling prices of the same samples. The conclusions reached pointed to the fact that prices and quality were not necessarily comparable. The relationship of production and markets also received consideration. This work was published in the *Malayan Agricultural Journal*, Vol. XIV, page 37.

The market price has fallen considerably during the year and the present price of $9.50 per pikul for bale gambier leaves little margin for profit.

The leaf-rolling caterpillars of the moth *Glyphodes Coeruleiceps* are generally present in small numbers on the leaves of gambier. Reports from Johore and Pahang show that they occasionally cause considerable damage.

44. Annatto.—There is, apparently, a very limited market for this product and the present prices would barely cover the cost of collection and preparation.

45. Tuba.—There has been an extension of the area planted with this crop by Japanese in Johore where a further considerable area may possibly be planted on a European-owned estate in the near future.

Experiments are being conducted at Serdang to test the comparative values of different varieties of tuba in respect both of yield and of insecticidal properties.

The position of tuba on the world's market was studied. The efforts of the department have persuaded various insecticide manufacturers to carry out experiments regarding the economic use of this product.

46. Chaulmoogra Oil.—Interesting experiments from a medical point of view are being carried out at Serdang to ascertain if it is possible to produce a local supply of chaulmoogra oil for the treatment of leprosy. The oil is obtained from the seeds of the trees *Hydnocarpus anthelmintica, H. Wightiana and Taraktog enos Kurzii.* Plots of all three trees have been established and some trees of *Hydnocarpus*

anthelmintica fruited for the first time in 1926; trees of the two other species have not yet reached the fruiting stage. A special report on the behaviour of these trees in this country was sent to the Royal Botanic Gardens, Kew, for publication in the *Bulletin of Miscellaneous Information*. A reprint of the report will be published later in the *Malayan Agricultural Journal*.

47. Cover Crops.—Of the numerous cover crops under trial at Serdang, *Calapogonium mucunoides*, *Centrosema pubescens*, *Dolichos Hosei* (the Sarawak Bean) and *Pueraria javanica* appear at present to be the most suitable, low-growing covers for the prevention of soil wash on hilly or undulating land.

48. Bananas.—Twenty standard named varieties of bananas planted during the latter part of 1925 at Serdang as a catch-crop in two one-acre plots amongst oil palms were subject to observation. These plots form part of an experiment to ascertain the effect of various catch-crops on the growth of oil palms.

A similar number of varieties were picked out as being of major importance and a commencement was made to plant up seven suckers of each variety in the newly established fruit nursery. Detailed data are being recorded regarding these varieties with special reference to the period of maturity, yield and quality of the fruits.

The Mycologist is now making a special investigation of banana diseases in order to ascertain whether any varieties are immune to "Panama" disease.

The menace to the banana industry of this disease and the necessity of discovering a variety immune to it are emphasised by the Imperial Economic Committee in their third report entitled "Fruit" (1926).

49. Other Fruits.—The fruit nursery at Serdang was laid out and well-stocked with various seedlings for planting up the newly opened area where investigations on local fruit trees will be conducted.

The Imperial Economic Committee in their report mentioned in the previous paragraph draw attention to the volume of the nut trade, and to the very substantial increase in it since the war; they state that this increase is largely due to the very considerable development which has taken place in the trade in Brazil nuts.

The Brazil nut grows well in Malaya, as has been pointed out in articles in the *Malayan Agricultural Journal*. There are a number of mature trees near the offices of the Department of Agriculture at Kuala Lumpur, which are fruiting well; and an area of five acres has been planted at Serdang. In addition to this a few trees have been planted in various parts of the Peninsula; and the department has at times seedlings for disposal. But so far cultivation has not been undertaken commercially.

50. Grasses.—Experiments at Serdang show that Guinea grass, *Panicum maximum*, is by far the most suitable for fodder. A recent introduction is Buffalo grass, *Euchlaena* (*Reana*) *luxurians*, which is a rather course type of grass giving a heavy yield; its suitability for feeding purposes has not yet been tested. A preliminary test was conducted with Molasses grass, *Melinis minutiflora*, the results of which have been published in the *Malayan Agricultural Journal*, Vol. XIV, page 296.

51. Minor Food Crops.—The Economic Botanist has commenced selection experiments on local types of maize and ground nuts and also on varieties of Soya bean collected from Burma, Siam and local sources. Experiments with imported and local varieties of sweet potatoes, yams and maize are being continued at Serdang.

MISCELLANEOUS INVESTIGATIONS.

52. Chemical Investigations.—In addition to the research work already indicated in connection with the crops mentioned above the following problems received attention.

Coagulation and preservation of Jelutong latex have been studied. A preliminary report on coagulation was issued in the *Malayan Agricultural Journal*, Vol. XIV, page 275. Subsequent work has led to an improved method of coagulation and a method of preservation. By means of these it has been found possible to treat successfully on a commercial basis, the daily output of latex from the Weld Hill Forest Reserve. The improved product prepared by this method commands a premium in the trade.

The work on oils and fats has included examinations of minyak losoh (*Cinnamomum parthenoxylon*), of minyak sepetir (*Sindora sp.*) and of soap nuts (*Sapindus saponaria*); a comparison of local Chinese wood oil with that obtained from Shanghai and Hankow; and an investigation of the oil content of piquia fruits (*Caryocar villosum*), including the characteristics of this oil.

Some of the work on oils was undertaken on behalf of the Forests Department for whom, in addition a report on adhesives was prepared and methods of tapping and extracting gutta-percha were examined.

Two hundred and three samples of soil were examined, many of them from areas under consideration for palanting padi, oil palm or rubber. Analyses of water for irrigating padi areas were also made.

Experiments of the preparation of A.D.C.O. fertiliser (synthetic farmyard manure) from lalang and other vegetable waste-products have given encouraging results. Field trials with the manure made from lalang are now in progress on tapioca plots at Serdang. Two kinds of cover crops have been analysed to test their manurial value and analyses have also been made of various guanos and locally available artificial manures.

Investigations of crops harvested at Serdang have included the determination at regular intervals of the sugar contents of twenty-two varieties of sugar cane, in order to ascertain the optimum period for harvesting each variety. They have also included determinations of the nicotine content of tobacco samples, the alkaloidal content of ipecacuanha, and the tensile strength of samples of Manila Hemp.

53. Mycological Investigations.—In addition to the work on crop diseases already mentioned, various other matters of interest have been investigated.

Several specimens were received from the Forests Department. Seedlings of Berus, Chengal timber and a fungus attacking stored Keruing wood were kept under observation. Determinations of fungi attacking the roots of Gutta Taban (*Palaquium oblongifolium*) showed that, while on one specimen *Fomes lignosus* was unmistakeably present, the more serious disease of old trees is a "wet-rot" closely simulating the appearance of "Wet Root Rot" of rubber caused by *Fomes pseudo-ferreus*. It was also found that the branches of Gutta Taban are liable to attacks of Pink Disease (*Corticium salmonicolor*).

The imported Piquia nut (*Caryocar villosum*) has been found to be liable to several types of root disease in this country.

Cultural work and inoculation experiments with fungi associated with diseases of lime trees (*Citrus* sp.) and lemon grass (*Cymbopogon citratus*) have been carried out by the Assistant Mycologist.

Mr. A. Thompson, First Assistant Mycologist, spent some weeks working at the Imperial Bureau of Mycology on species of Phytophthora which had been isolated from various plants in Malaya. This group of fungi is responsible for important disease of a variety of crops all over the world. The distinctive characters and range of host plants of each species are as yet by no means fully ascertained, while a complicating factor is the probable occurrence within the species of biological races, each of which may be limited in its range of hosts and in its geographical distribution. A full elucidation of these problems would be of great value in reducing the loss caused by this important group of parasites.

54. Entomological Investigations.—In addition to work on individual pests, the Entomological Division has devoted considerable time in recent years to collecting and recording the insects of economic importance and their host plants in Malaya. The results so far obtained were published in Special Bulletin No. 38, "A Preliminary List of Food-plants of Some Malayan Insects from the Records Obtained in the Entomological Laboratory from 1920-1025". Further progress was made during the year with this survey of the economic insects of Malaya, an important line of investigation of which even the approximate completion cannot be obtained for several years.

GENERAL.

55. Cameron's Highlands.—Good work was done on the experimental area where experiments with hill crops, especially cinchona and tea, are being conducted. An area of about 75 acres was opened and part of it was successfully planted. In addition to tea and cinchona, coffee, suitable fruit trees, grasses and ornamental trees have been established.

56. Castleton Estate.—The Government Rubber Estate at Telok Anson, being no longer required for experimental purposes, was sold in February, 1926, and realised the good price of $210,000, or $1,066 an acre.

57. Agricultural Shows.—The Malayan Agri-Horticultural Association held a successful four days' Exhibition at Kuala Lumpur from August 27th to 30th. The Department of Agriculture prepared a special exhibit demonstrating—(*a*) areca nut varieties and products; (*b*) coconut varieties, cultivation, pests and diseases; (*c*) Sisal hemp; (*d*) cover crops; (*e*) padi varieties; (*f*) the Giant Snail (*Achatina fulica*); and (*g*) models of common pests and diseases of rubber and coconuts. The Johore Government, through their Inspector of Agriculture, added a very attractive exhibit of the pineapple and tapioca industries.

Under the auspices of the association nine District Shows were held, eight in the Federated Malay States and one in Malacca.

58. Paris Exhibition.—A representative exhibit of crops other than rubber, prepared by the Agricultural Chemist, was displayed by the Malay States Information Agency at the Seventh International Exhibition of Rubber and allied products in Paris.

59. Pacific Science Congress.—Dr. H. W. Jack, Economic Botanist, represented the department at the Third Pacific Science Congress held in Tokio during October and November. Papers were also contributed by other officers of the department. Much useful work was done and valuable information was obtained, much of which was due to the excellent and most hospitable arrangements made by the hosts for displaying the agricultural resources and organisation of Japan.

60. Incorporated Society of Planters' Conference and Lectures.—A conference under the auspices of the Incorporated Society of Planters' was held in Kuala Lumpur on June 17th to 19th, at which lectures were given by three officers of the department.

Other lectures were also delivered by officers of the department before branches of the Incorporated Society of Planters in different districts.

61. Agricultural Instruction.—The training of Malay officers for the department was continued on the lines described in the report for 1925. Of the 23 students in training at the beginning of the year, one resigned, leaving a class of 22 second-year students. One further resignation, one dismissal and one death reduced this class to 19 students at the end of the year. Eleven new Malay apprentices were appointed in May, constituting the first-year class. This remained unaltered through the remainder of the year, so that in the two classes there were 30 students in December.

In addition to the various science subjects taught, the students were given instruction in type-writing one evening a week at the Gombak Lane School. One hour each week was devoted to lectures by the students themselves and a similar period to debating, the object of this training being to improve their knowledge of English and to give them confidence in public speaking such as is necessary when holding demonstrations or giving evidence in Court.

At the end of the year the second-year students were given final examinations in Entomology, Mycology and Chemistry and progress examinations in Botany and Agriculture.

62. Agricultural School.—A committee, of which the Secretary for Agriculture and the Agricultural Economist were members, was appointed to consider proposals for the establishment of an Agricultural School. Its report was presented in December for the consideration of Government.

63. School Gardens.—On the whole good progress was made with school gardens everywhere, except perhaps in Pahang where seed supplies were insufficient and, though the land was kept in good order, it was often found that few plants were actually being grown. In most places both teachers and pupils evince a keen interest in their gardens, which is stimulated when arrangements can be made for competition between schools at local Agricultural Shows. In Negri Sembilan some of the pupils grow vegetables on their parents' land.

This department provided supplies of tools, manure, lime and planting materials; in particular, good imported varieties of maize (sweet corn) ground nuts, sweet potatoes and tapioca, grown successfully at Serdang, were distributed to all schools with gardens.

64. Library and Publications.—The work in the library has progressed steadily throughout the year, but much binding still remains to be done. The Librarian made numerous translations of scientific articles for officers of the department.

The monthly publication of the *Malayan Agricultural Journal* was continued. The number of subscribers increased by 38 per cent., the large majority of whom were local subscribers. Four quarterly numbers, completing the fourth volume, of the Malay publication "Warta Perusaha-an Tanah" were published. Of one number containing articles on cultivation and diseases of rubber 10,000 copies were printed. These were in considerable demand throughout the Peninsula. Of each of the remaining three numbers 3,000 copies were distributed. In addition a series of special agricultural pamphlets in the Malay language was started. The two issued during the year dealt with "Kermut" (an important insect pest in Pahang) and "Tapping of Rubber."

Arrangements were made to issue early in 1927 a publication in Chinese similar to the "Warta Perusaha-an Tanah".

The collection of slides at the Malay States Information Agency was further augmented by 47 photographs of agricultural subjects.

The annual reports of Heads of Divisions of the Department will be published as usual in the *Malayan Agricultural Journal.*

65. Food Production.—One of the most vital needs of the country as has been pointed out many times in the past, is to grow more rice, the staple food of the population. The notable work done at the Titi Serong Rice Experiment Station in producing improved strains which give higher yields and possess other valuable qualities is mentioned elsewhere in this report; that work is of course continuous. It has for some time been appreciated by the Malay padi-planters, amongst whom there is great demand for any seed available.

What is further needed however is irrigation and drainage for the improvement of existing padi areas and for the opening of new areas to padi in localities which after investigation are proved suitable.

Kuala Lumpur,
30th May, 1927.

A. S. HAYNES,
Secretary for Agriculture, S.S. and F.M.S.

APPENDIX A.

STAFF.

1. SECRETARY FOR AGRICULTURE.—Mr. B. W. Elles was in charge of the department as Acting Secretary for Agriculture from the 1st January to the 8th February and from the 14th April to the end of the year.

2. ASSISTANT TO SECRETARY FOR AGRICULTURE.—Mr. D. H. Grist (Agricultural Economist) acted throughout the year in addition to his own duties. Mr. A. Sharples (Mycologist) was Editor of the *Malayan Agricultural Journal*.

3. CHEMICAL DIVISION.—Major B. J. Eaton, O.B.E. (Agricultural Chemist), was in charge from 1st January to 8th February, Major C. D. V. Georgi, O.B.E., acted from 9th February to 23rd April, while Major Eaton was Acting Secretary for Agriculture, Major Eaton again took charge from 24th April to 31st October, when he was seconded for service with the Rubber Research Institute and Mr. R. O. Bishop, M.B.E., was appointed to act in his place.

ASSISTANT AGRICULTURAL CHEMISTS.—Mr. R. O. Bishop, M.B.E. (Acting Plant Physiologist), from the 1st January to the 14th September. Major C. D. V. Georgi, O.B.E., Mr. V. R. Greenstreet (on leave till 3rd March). Mr. J. H. Dennett (on leave till 26th October).

ASSISTANT ANALYST.—Mr. Gun Lay Teik.

4. FIELD DIVISION.—Mr. F. W. South returned from leave and resumed duty as Chief Agricultural Field Officer on the 1st January.

AGRICULTURAL FIELD OFFICERS.—The officers were distributed among the various States as follows:

Perak North.—Mr. F. Birkinshaw.

Perak South.—Mr. A. E. Coleman Doscas from 7th January to 31st December.

Selangor.—Mr. G. E. Mann, M.C., 1st January to 26th February when he proceeded on leave, Mr. F. W. South from 27th February to 7th October, in addition to his own duties. Mr. G. E. Mann from 8th October to 3rd December, Mr. R. B. Jagoe from 4th to 31st December (Mr. Jagoe was appointed an Agricultural Field Officer on 10th September and reported for duty on 8th October, spending the interval until the 4th December in gaining local experience of his duties).

Negri Sembilan.—Mr. W. H. Barnes (Temporary Agricultural Field Officer).

Pahang West.—Mr. J. W. Jolly.

Pahang East.—Mr. J. C. Sworder (Temporary Agricultural Field Officer) from 1st January to 15th December. Mr. J. M. Howlett, Agricultural Instructor (Malay Officers), was transferred to the Field Division on his return from leave on the 4th December and was appointed to Pahang East on the 16th December.

Province Wellesley and Penang.—Mr. F. R. Mason from 1st January to 10th April when he proceeded on leave, Mr. F. Birkinshaw in addition to his own duties, from 11th April to 17th December when Mr. Mason returned from leave and resumed duty.

Malacca.—Mr. J. Fairweather who returned from leave on the 31st December, 1925.

Singapore.—Mr. F. W. South, in addition to his own duties, no officer being available to fill this vacancy during the year.

The remaining officer of the Field Division Mr. F. de la M. Norris continued to act as Inspector of Agriculture, Johore.

5. MYCOLOGICAL DIVISION.—Mr. A. Sharples (Mycologist) was in charge of the Division throughout the year.

ASSISTANT MYCOLOGISTS.—Mr. A. Thompson (on leave from the 12th March to the 14th November). Mr. F. S. Ward who was appointed in December, 1925, and reported for duty on the 16th January.

6. ENTOMOLOGICAL DIVISION.—Mr. G. H. Corbett (Government Entomologist) was in charge of the Division throughout the year.

ASSISTANT ENTOMOLOGIST.—Mr. B. A. R. Gater till the 31st October when he was transferred to the appointment of Malaria Research Officer.

7. DIVISION OF PLANT PHYSIOLOGY.—Mr. R. O. Bishop, M.B.E. (Assistant Agricultural Chemist), acted as Plant Physiologist from the 1st January to the 14th September when Mr. W. N. C. Belgrave (Plant Physiologist) resumed duty on return from leave.

8. BOTANICAL DIVISION.—Mr. W. N. Sands (Assistant Botanist) was in charge until the return from leave of Dr. H. W. Jack (Economic Botanist) on the 24th May. Mr. Sands again acted as Economic Botanist during Dr. Jack's absence on duty at the Third Pacific Science Conference in Japan from the 26th September to the 2nd December.

9. Agricultural Division.—Mr. B. Bunting (Agriculturist) was in charge of the Division throughout the year. Mr. F. G. Spring (Agriculturist, Rubber) was in charge of the Agricultural Division (Rubber) throughout the year.

Assistant Agriculturist.—Mr. J. N. Milsum, Mr. E. A. Curtler (on leave from the 19th June for the remainder of the year). Mr. T. D. Marsh (on leave till the 16th July). Mr. J. Lambourne.

Superintendent, Government Plantations, Kuala Lumpur.—Mr. H. C. Chevally (temporarily employed) left the service on the 13th January and Mr. A. L. Sinclair was appointed temporarily to replace him on the 13th March.

10. Economic Division.—Mr. D. H. Grist (Agricultural Economist) was in charge throughout the year.

11. Agricultural Instruction (Malay Officers).—Captain J. M. Howlett, M.C. (Agricultural Instructor, Malay Officers), was in charge until the 10th April when he proceeded on leave. During his absence Mr. D. H. Grist (Agricultural Economist) was responsible for the administration of the Divison, and the teaching duties were performed by certain senior officers of the department and by the Assistant Agricultural Instructor Raja Mahmud. On his return from leave on the 4th December, Captain Howlett was transferred to the Field Division and Mr. G. E. Mann, M.C., assumed duty as Agricultural Instructor (Malay Officers).

12. Library.—Mr. L. A. Rijk was in charge of the Library throughout the year.

13. The substantive appointments of Assistant to Secretary for Agriculture, Second Assistant Economic Botanist, Second Assistant Entomologist and Agricultural Field Officer, Singapore, were not filled throughout the year.

Appendix B.

SUMMARY OF PADI RETURNS—BRITISH MALAYA. SEASON 1925-26.

State or Settlement.	Wet.		Dry.	
	Acreage.	Yield.	Acreage.	Yield.
Federated Malay States.				
Perak	89,923	20,514,904	3,518	444,994
Selangor	15,745	2,867,576	4,783	669,677
Negri Sembilan ...	31,305	3,982,262	15	300
Pahang	26,147	4,003,620	2,826	404,801
Total F.M.S. ...	163,120	31,368,362	11,142	1,519,772
Krian	*54,669*	*14,092,629*	*55*	*4,400*
Straits Settlements.				
Singapore	—	—	—	—
Penang	5,060	1,025,500	—	—
Malacca	27,061	11,666,220	—	—
Province Wellesley	39,390	7,478,000	—	—
Dindings*	400	40,000	330	33,000
Total S.S. ...	71,911	20,209,720	330	33,000
Unfederated Malay States.				
Johore	3,866	384,187	1,462	126,524
Kedah	162,432	32,120,720	3,635	659,106
Perlis	65,139	9,005,600	300	42,080
Kelantan†	109,247	19,150,000	61,313	7,175,000
Trengganu	8,000	1,200,000	4,000	500,000
Total U.M.S. ...	348,684	61,860,507	70,710	8,502,710
Summary—F.M.S., S.S. and U.M.S.				
Total F.M.S. ...	163,120	31,368,362	11,142	1,519,772
,, S.S.	71,911	20,209,720	330	33,000
,, U.M.S. ...	348,684	61,860,507	70,710	8,502,710
Grand Total Malaya	583,715	113,438,589	82,182	10,055,482

* Figures for season 1924-25 given as figures for season 1925-26 have not yet come to hand.

† Approximate estimate only since part of the records were destroyed by fire.

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